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Records of prolegs absence and crochet deformities in caterpillar of tasar silk worm *Antheraea mylitta* Drury

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ABSTRACT

Authors reporting the records of proleg absence and crochet deformities in caterpillars of *Antheraea mylitta* Drury reared in natural condition.

Key words: Proleg, Crochet, Absent, Deformities, Caterpillars, Hydrostatic pressure.

1. INTRODUCTION

The indirect developmental patterns in many insect orders having egg, larvae, pupae and imago stage and larval stage performs locomotion in search of food or in search of desirable extent for nutrition and survival. For locomotion, some holometabolous insect larvae possess abdominal appendages called as prolegs (Nagy and Grbic, 1999; Snodgrass, 1935). In the species of insect orders including Lepidoptera (moths and butterflies), Mecoptera (hanging flies and scorpion flies) and Hymenoptera (sawflies, wasp, bees and ants) caterpillar larvae usually have 3 pair of jointed legs on each of the three thoracic segments and paired prolegs on some or all of the ten abdominal segments. In lepidopteran caterpillar's 3rd-6th and 10th abdominal somites bearing prolegs armed with series of different type of crochets. According to some scientist, the extension of proleg occurs due to hydrostatic pressure (*Williamson et al., 2009*).

The complex interaction among muscle function, neural commands, shape and properties of the body allows to make movements to all living creatures on the earth. In animals, movement can be predicted but in view of soft body animals it is more difficult to draw a prediction of movement concept. For such kind of creatures, the shape of body and mechanical support of tissues play an important role in controlling and generation of movements (Buschmann and Trimmer, 2017; Hanassy et al., 2015; Richter et al., 2015; Sumbre et al., 2005; Trimmer and Lin, 2014). In the caterpillar prolegs also perform an important role in locomotion along with actual legs. During locomotion larval body propelled with the help of longitudinal muscles present in each abdominal segment. The muscles provide more of the force

required to locomotion and produces a caterpillar gait due to precise timing of griping and releasing the abdominal prolegs (Metallo et al., 2020).

To date, deformities in adult insects, deformities in some larvae induced by pesticides, insecticides and chemogenic treatments are known to us, but the absence of locomotory organs in natural condition are yet not been reported. For the first time we observed the absence of two prolegs and crochets deficiency or deformity in caterpillars of *Antheraea mylitta* Drury (Daba Trivoltine) in natural rearing conditions.

In the struniidae, prolegs occurs on somites 3rd–6th, 10th and perform the locomotory movements. During tasar silk-based research we reared caterpillars of *Antheraea mylitta* Drury (Daba Trivoltine Eco-race) in natural condition and accidently observed a caterpillar with crochet deformities. After this observation we carefully observed each and every caterpillar and in the third generation we again observed a 3rd instar caterpillar with absence of prolegs in 5th and 6th abdominal segments and another two with crochet absence or deformities. During observation caterpillar morphology exist same as previous after molting also.

2. MATERIALS AND METHODS

The 20 healthy caterpillars (first generation) of *Antheraea mylitta* Drury was reared on *Terminalia arjuna* plants in natural condition for research purpose in the month of August 2021. After observing the crochet deformity in a 4th instar caterpillar in second generation, morphology of each larva has been checked carefully under the dissection microscope. In the 3rd generation of reared *A. mylitta* caterpillars, we observed a 3rd instar caterpillar with proleg absence and another two caterpillar with proleg partially developed but crochet was absent. Caterpillars were observed regularly till molting to understand the possible morphological changes or recovery of prolegs deformities after molting. A total number of 120 caterpillars was reared during study and 4 caterpillars was found with different level of proleg deformities.

3. RESULT AND DISCUSSION

In our experience with *A.* mylitta caterpillar reared in natural condition, proleg absence and deformities were observed. The results of our observation with *A.* mylitta caterpillar raise questions about the mechanisms responsible for this kind of deformities. First, may larval density have led to this result? One possibility is that stress resulting from crowding of caterpillars caused changes of internal chemical conditions that altered normal developmental processes of caterpillars of *A.* mylitta. In the moth *Lymantria dispar*, larval crowding results in decreased concentration of the dopamine hormone (Pavlushin et al. 2019). In locusts, when population density stays higher causes solitary-to-gregarious phase transformation (reviewed by Ayali 2019).

Secondly, could external chemical factors, either volatile or non-volatile, have performed a role in proleg and crochet alterations? E.g., in locusts: volatiles from frass and body odours affect the transition from solitary-to-gregarious phase (Heifetz et al. 1996, Wei et al. 2017, Ayali 2019).

Thirdly, could morphological deformities have been performed by the effects of larval crowding?. Caterpillar-to-caterpillar contact resulted in injury might have occurred in crowded conditions, so some prolegs and crochets may have been damaged during feeding in the 2nd and 3rd instar. The crowding effects on life history traits appear to be common phenomena in some insects but we are unaware about any density-related occurrences of missing or deformed prolegs.

In addition to the discussed possibility for mechanisms responsible to proleg absence or deformities, we are also mindful of hydrostatic pressure loss in specific abdominal segment and the loss of complete proleg happened. Further detailed studies will be needed to understand the region behind absence or deformities of proleg in struniidae caterpillars and to understand the impacts of aforesaid issue on larval locomotion, feeding behaviour and survival. Present study will be surely helpful in understand the issues related to proleg absence or deformities in lepidopteran caterpillars.

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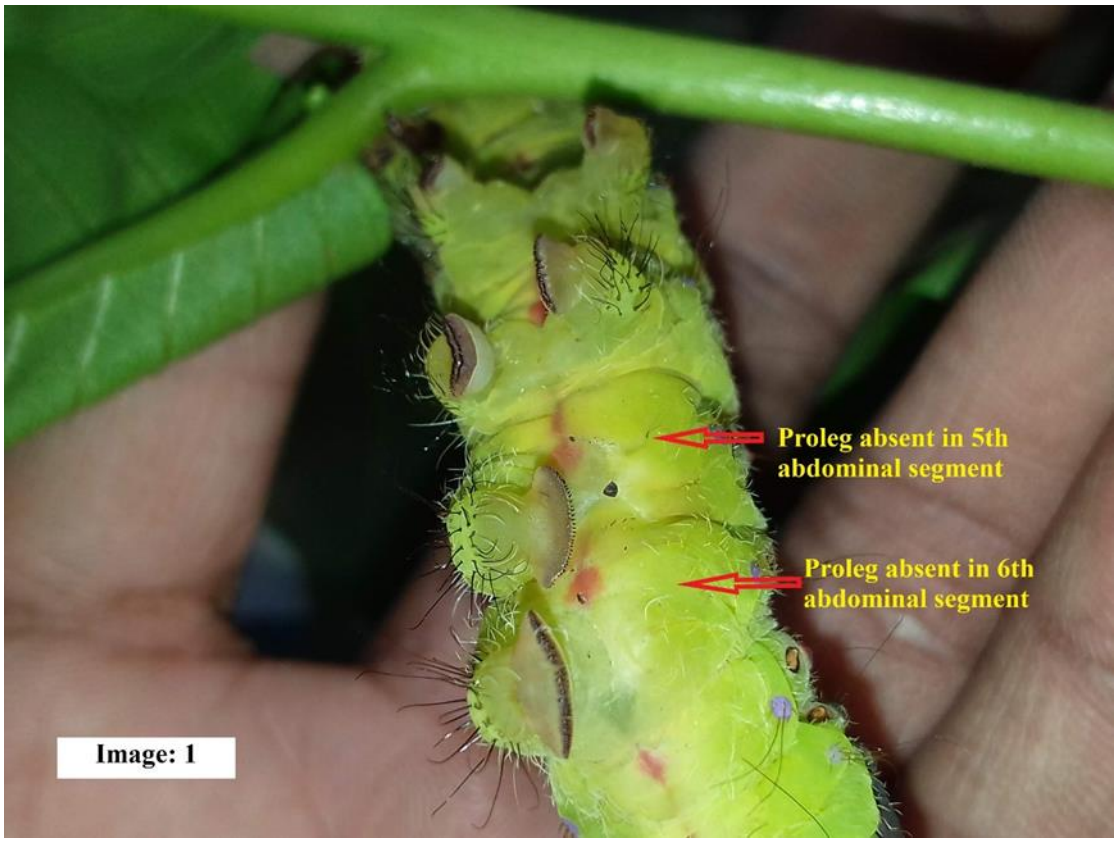

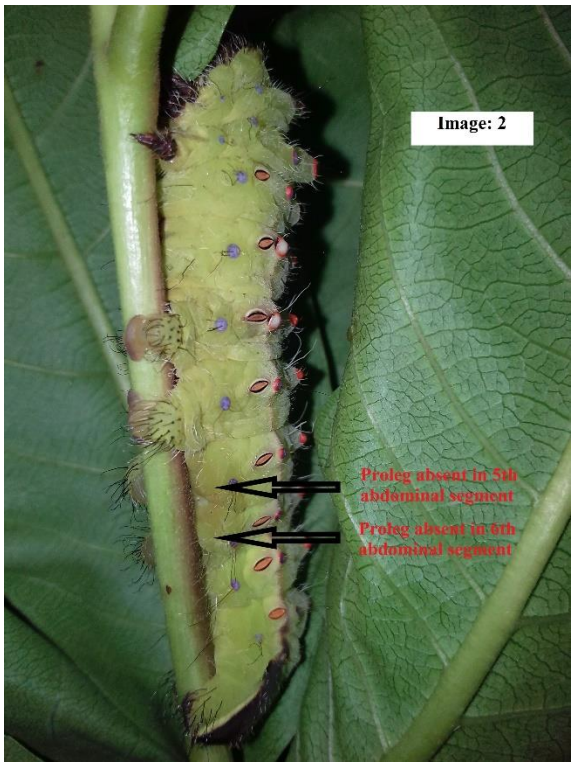

Image: 1 & 2. Showing proleg absence in 5th and 6th abdominal segment in 4th instar caterpillar of *Antheraea mylitta*.

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Image: 3. Showing partially developed proleg in 5th abdominal segment but absence of crochets in 5th instar caterpillar of *Antheraea mylitta*.

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Authors Contribution

First author and second author done the field rearing and observation, taken images and prepared the paper while senior author helped in literature review along with supervision during the research work.

Ethical approval

Antheraea mylitta Drury was observed in the study. The ethical guidelines are followed in the study for sample collection & identification.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Ayali, A. (2019). The puzzle of locust density-dependent phase polyphenism. Curr. Opin. Insect Sci. 35: 41–47.
2. Buschmann, T. and Trimmer, B. (2017). Bio-inspired robot locomotion. In The Neurobiology of Motor Control:

Fundamental Concepts and New Directions (ed. S. L. Hooper and A. Büschges), pp. 443-472: Wiley-Blackwell.

3. *Williamson, Donald I. (2009).* Caterpillars evolved from onychophorans by hybridogenesis. Proceedings of the National Academy of Sciences. *106 (47): 19901–19905.*
4. Hanassy, S., Botvinnik, A., Flash, T. and Hochner, B. (2015). Stereotypical reaching movements of the octopus involve both bend propagation and arm elongation. Bioinspir. Biomim. 10, 035001. doi:10.1088/1748-3190/10/3/035001
5. Heifetz, Y., H. Voet, and S. W. Applebaum. (1996). Factors affecting behavioral phase transition in the desert locust, Schistocerca gregaria (Forskål) (Orthoptera: Acrididae). J. Chem. Ecol. 22: 1717–1734.
6. Metallo, C., Mukherjee, R. and Trimmer, B. A. (2020). Stepping pattern changes in the caterpillar Manduca sexta: the effects of orientation and substrate. J. Exp. Biol. 223, jeb220319. doi:10.1242/jeb.220319
7. Nagy, L.M., Grbic, M., (1999). Cell lineages in larval development and evolution of holometabolous insects. In: Hall, B.K., Wake, M.H. (Eds.), The Origin and Evolution of Larval Forms. Academic Press, San Diego, pp. 275–300.
8. Pavlushin, S. V., I. A. Belousova, E. A. Chertkova, N. A. Kryukova, V. V. Glupov, and V. V. Martemyanov. (2019). The effect of population density of Lymantria dispar (Lepidoptera: Erebidae) on its fitness, physiology and activation of the covert nucleopolyhedrovirus. Eur. J. Entomol. 116: 85–91.
9. Richter, J. N., Hochner, B. and Kuba, M. J. (2015). Octopus arm movements under constrained conditions: adaptation, modification and plasticity of motor primitives. J. Exp. Biol. 218, 1069-1076. doi:10.1242/jeb.115915
10. Snodgrass, R.E. (1935). Principles of Insect Morphology. Cornell University Press, Ithaca, NY.
11. Trimmer, B. A. and Lin, H.-T. (2014). Bone-free: soft mechanics for adaptive locomotion. Integr. Comp. Biol. 54, 1122-1135. doi:10.1093/icb/icu076
12. Wei, J. N., W. B. Shao, X. H. Wang, J. Ge, X. Chen, D. Yu, and L. Kang. (2017). Composition and emission dynamics of migratory locust volatiles in response to changes in developmental stages and population density. Insect Sci. 24: 60–72.

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